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ABSTRACT

Presented are appendices to a series of four manuals of marine education activiLies produced by North Carolina teachers and college faculty under a Sea Grant project entitled "Man and the Seacoast." Information on relevant films, periodicals, federal and state resources, games, and marine careers is provided. Also included are directions for keeping a marine aquarium, and "Shifting Sands" which is a guide to field trips along the North Carolina coast. (WB)

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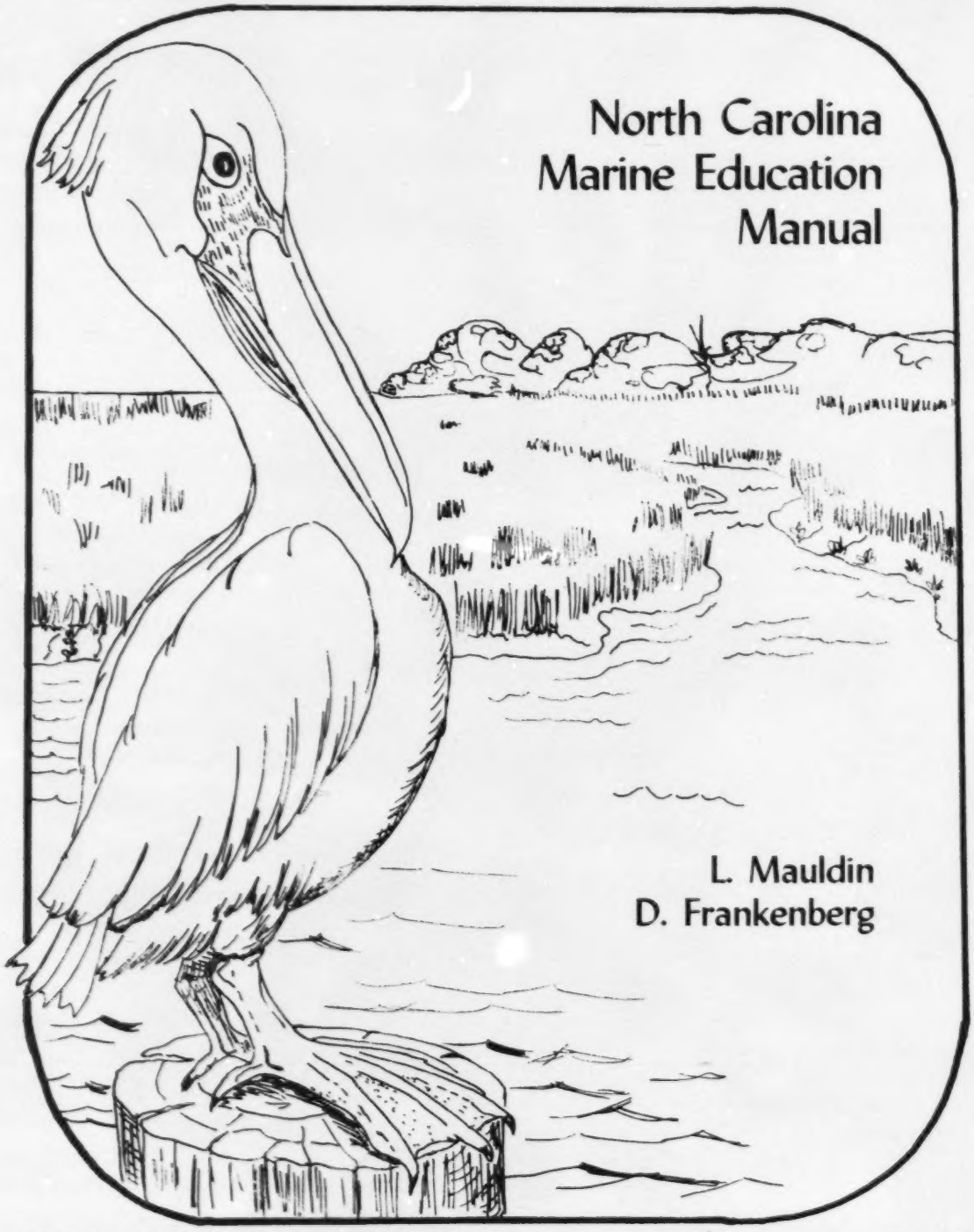

North Carolina Marine Education Manual

L. Mauldin
D. Frankenberg

UNC Sea Grant Publication UNC-SG-78-14-D

August, 1978

ED198014

SE 034 401

Residents of North Carolina may request a single copy free of charge.
Copies are available from: UNC Sea Grant
105 1911 Building
North Carolina State University
Raleigh, N.C. 27607

NORTH CAROLINA MARINE EDUCATION MANUAL

APPENDICES

LUNDIE MAULDIN
UNC Sea Grant College Program

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UNC, Chapel Hill

Illustrated by Lundie Mauldin and Johanna Bazzolo

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The North Carolina Marine Education Manual is a collection of teaching materials generated by North Carolina public school teachers and university professors under a University of North Carolina Sea Grant College project entitled "Man and the Seacoast." Dr. Dirk Frankenberg is the principle investigator; the Resource Unit Development Committee project directed by Dr. William Rickards of North Carolina State University assisted with material production. The manual is designed to help middle school teachers put marine perspectives into their lessons. The activities can be modified for higher or lower grades.

This manual consists of separate units which cover environmental aspects of the coast such as geology, ecology, and seawater interactions and motions. Additional units cover facets of coastal communities and economics, history, anthropology, art, folklore, and literature. An appendix provides information on keeping aquaria, state and federal agencies, field trip guides, and film company addresses.

We wish to acknowledge the cooperation we have received from other marine education projects, North Carolina Marine Resource Centers, North Carolina Department of Public Instruction, National Marine Education Association, and many people who have contributed suggestions and opinions. Especially we wish to thank those people whose enthusiasm and contributions made this project possible -- the following North Carolina teachers:

1977 "Man and the Seacoast" teachers

Charlie Baker, Wells Baker, Edna Bell, John Britt, Fay Edwards, Marie Farris, George Glasson, Gwendolyn Guerrant, Clayton A. Harpold, Linda L. Helms, Katherine Helsing, Jan Jones, Connie Long, Lillie R. McInnis, Martha S. Mallard, Mary Olson, Laurie Oppenheimer, Donna Parrish, Barbara Ratliff, Julia Tingle, and Susan Warren.

1977 "Man and the Seacoast" staff

Dr. David Brower, Dr. Dirk Frankenberg, Dr. Richard King, Dr. Jerry Machemehl, Dr. David Phelps, Dr. James Sabella, Dr. John D. Seelye, and Dr. William N. Still. Graduate assistants: Johanna Bazzolo, Mike Duncan, and Joe Gutierrez.

1977 "Resource Unit Development Committee"

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Cindy Cantrell deserves a special note of acknowledgement for typing this manuscript. Thanks to Nancy Tomkovick and Paul Belyea for assisting with the manuscript preparation. We also appreciate the organizational assistance of Johanna Bazzolo.

The North Carolina Marine Education Manual developed through the interaction and involvement of people interested in marine education. UNC Sea Grant would like to continue the involvement by inviting your opinions and suggestions for topics and activities. In this way, we can remain responsive to your needs with new additions to the manual.

Please address your comments to:

UNC Sea Grant College Program
Marine Education Specialist
North Carolina State University
105-1911 Building
Raleigh, NC 27650

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APPENDIX A

The Marine Aquarium

Teaching about the sea from a classroom setting can be made more exciting by having a marine aquarium. Living marine animals are fascinating to watch and they constantly demonstrate behavior and biological relationships. Then, the water in which sea animals live adjusts to environmental pressures. Many of the changes in sea water can be measured: salinity, pH, nitrate and phosphate, dissolved oxygen, and temperature. Monitoring an aquarium is an interesting investigation in itself.

Setting up a marine aquarium requires an initial expense (or donation), care in its placement (not too close to the radiator, door, window), and regular maintenance once established. Students are usually interested in working with aquaria and can provide most of the maintenance and monitoring help. Your aquarium should be at least a 20 gallon tank or a row of gallon jars. Some suggestions to aid and encourage you are given below.

a. Prepare the tank: Obtain an all glass aquarium without a metal frame. Most marine organisms need a lot of water so be sure the aquarium will be big enough for your purposes. The usual size is between 10 and 30 gallons. Wash the aquarium with tap water and then rinse it with sea water.

b. Install the filter: Place an undergravel filter inside the aquarium and/or attach a pump circulating filter to the outside of the aquarium. The more water circulation you can provide the better. If you are using a box or outside filter, then you should also install an air stone to provide additional aeration.

c. Add gravel substrate: Obtain a quantity of gravel (crushed osyster shells about 5 mm (¼") in diameter are excellent as they help buffer the pH of sea water). If you are using an undergravel filter, the gravel will be placed on top of the filter and must not be small enough to fall through the openings in the filter. Enough gravel is needed to make a layer 5-7 cm (2-3") deep on the bottom of the aquarium. Rinse the gravel before using to remove any debris. Do not put any object into the tank that is made of metal.

d. Fill the tank with water: Obtain a supply of artificial sea water, e.g. "Instant Ocean", or very clean, settled sea water. Place a bowl, pan, or piece of paper on top of the sand in the aquarium to prevent the sand from being disturbed when the water is poured in. Fill the aquarium until the water level is about 2-3 cm (one inch) from the top of the tank. With magic marker, wax crayon, or tape, mark the outside of the tank at the water level in order to check evaporation.

e. Install a glass cover and an aquarium light (optional): A glass cover will reduce water loss from evaporation and a light will

help you see into the tank. The glass cover also prevents accidental trash (coins, gum, etc.) from being dropped into the tank.

f. Allow the aquarium system to run for 2-5 days to stabilize before adding any animal. The microbial population grows on the gravel substrate.

g. Stock the tank with 2-4 animals and if these thrive, you could add 2 or 3 more in a week. It is very important not to over-crowd the tank.

h. Avoid sharp changes in temperature, food, or water. Remove about 1/3 of the water every six weeks and add new sea water. Replace any water lost by evaporation (indicated by the water level sinking below the line you placed on tank in step d) with fresh water.

i. Choose animals which are hardy and have good survival records in a classroom situation. These can be ordered from several biological supply companies or brought back from a beach trip (in aerated, cool jars).

1. Marsh minows - mummichog, killifish, and sheepshead minnow.

2. Small flounder, eels, rock bass, or toadfish.

3. Starfish, sea anemones, and sea cucumbers are usually very hardy.

4. Very small crabs (hermit, blue, mud) are useful to clean up scraps. Too large or too many crabs will destroy all the other life.

5. Most small snails do well. (Remember the "marsh periwinkle" - littorina - breathes air.) Bivales like clams, mussels, or oysters live reasonably well. Barnacles are an added bonus if you find some on oyster shells.

6. Avoid seaweeds, algae, and sponges in the tank as they don't survive and easily foul a tank.

Aquarium Alternative

If you can't fit a water aquarium into your classroom yet or would like to complement your tank with more activities, an aquarium alternative is the "Black Box" approach, or a fish tank with no water. The idea is to simulate an aquarium using a cardboard box turned on its side. This is decorated to look like a tank with marine scenes, having hand made animals and plants either hanging from the top or standing on the sand bottom. Students can have several "tanks", learn about animals, and have a chance to use their own creativity with minimal cost.

Sample Scenes: which can be painted on the inside three walls: coral reefs, shipwreck, sand flats with grasses, rocky outcrops covered with barnacles and seaweeds, seashells, skin divers in deep ocean, man-made submarines and submersibles around underwater volcanoes and mountains. Natural history books and magazines like National Geographic would be good sources for ideas. Lining the walls with aluminum foil would reflect the animals.

Sample "Critters": to hang from top or stand on bottom: any type of fish cut from magazines, drawn and painted fish cut double from contruction paper, stuffed with a bit of cotton, then stapled together, or even dried real fish can be used. Attach a dark thread to fish and suspend it from the top. Try sharks, sailfish, trigger fish, trout, puffers, flying fish, snapper, octopus, squid, eels, jellyfish, or other distinctive shapes for older students.

Sample Bottom Dwellers and Plants: many of these can be real rocks, shells, corals, pieces of sponge, parts of animals like a crab claw, dried seaweed. Try cutting out green seaweeds from construction paper and supporting them with wire stands.

Sources of Information Concerning the Marine Aquarium

Carolina Marine Aquaria. $1.00 Carolina Biological Supply Company
Burlington, NC 27215

Dames, D.E. 1972. Carolina Tips, Vol. 35. Free pamphlets. #1 Try a Marine Aquarium. #2 Maintaining the Marine Aquarium. #9 Chemistry in the Marine Aquarium. Carolina Biological Supply Company.

Waters, Barbara. 1973. A Closed Salt Water System. $0.50.
Northeast Marine Specimens, Co., Inc.
P.O. Box 1
Woods Hole, MA 02543

Waters, Barbara. Ocean In Your Classroom, Part I - IV.
Cape Cod Extension Office
Railroad Avenue
Barnstable, MA 02630

Straughan, Robert. 1970. The Salt-Water Aquarium In The Home, 2nd edition. A.S. Barnes and Company, New York, NY 10001.

Marine Aquaria. Project Coast Packet #3. University of Delaware
Newark, DE 19711.

Reef and Shore: Hawaii Nature Study Program. 1976. Curriculum Research and Development Group. University of Hawaii
1776 University Avenue
Honolulu, HA 96822.
Excellent guide for maintaining and using aquaria and simple experiments with marine animals.

Source for Marine Animals: Carolina Biological Supply Company
Burlington, NC 27215

Gulf Specimen, Co., Inc.
P.O. Box 237
Panacea, FL 32346

Northeast Marine Specimen Co.
P.O. Box One
Woods Hole, MA 02543

Artificial Sea Water: Instant Ocean
Aquarium Systems, Inc.
33208 Lakeland Blvd.
Eastlake, OH 44094

Carolina Biological Supply Co.
Burlington, NC 27215

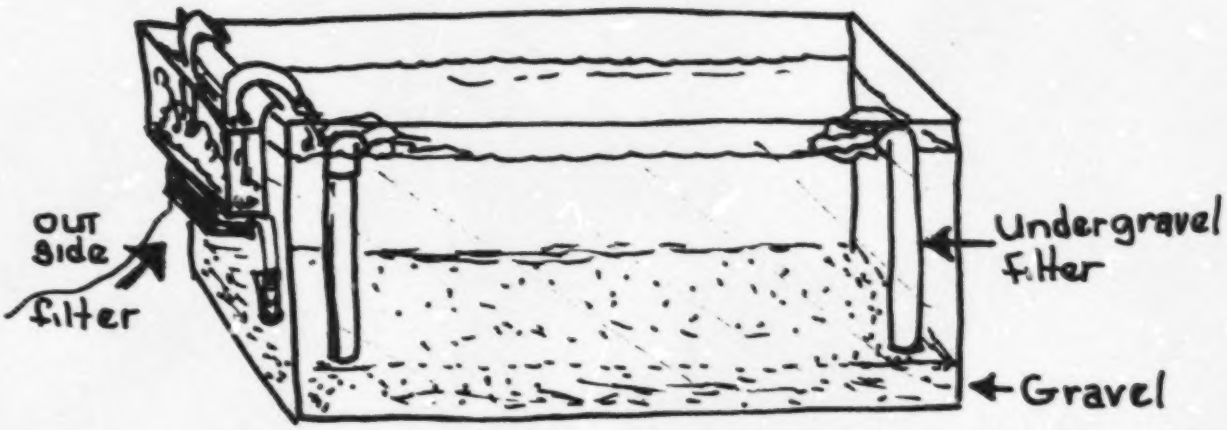
Chemical Testing Kits: HACH Chemical Kits
Ames, IA 50010

La Motte Chemical Products Co.
"Chemical Testing Equipment for
the Marine Aquarium"
Chestertown, MD 21620

Aquarium Filters and Pumps: "Silent Giant" pumps-sufficient pressure for two 20 gal. tanks or a series of gallon jars.

"Dynoflow" filter-sits outside tank.

"Biosurge" Undergravel filter by Nektonics.



APPENDIX B

Games in Marine Science Activities

1. Baseball

Objective: To review material by answering questions with one team competing against the other to provide motivation and enthusiasm.

Teacher Preparation: Duplicate series of questions must be prepared on the subject. Then the questions must be evaluated in four degrees of difficulty. Approximately 30 questions will be needed on index cards with the questions labeled, single, double, triple, homerun.

Class Set up: Class divided into two teams. Each team designates a pitcher (one who asks questions) for each inning. A scorer keeps track on the board the location of the runner's positions, strikes, and innings, etc.

Game Rules:

1. Coin toss for the team to bat first (answer questions).
2. Team A's pitcher reads the first question in the card series to the first batter on Team B.
3. If the question is answered correctly, the runner advances the number of bases as written on the card (1, 2, 3, homerun). If the question is answered wrong, and the opposing team can answer it, he is out; if no one on the opposing team can answer, he advances to first base.
4. Each team has 3 outs per inning.
5. The length of the game is determined by number of innings, number of runs, or the end of the period.

2. Bingo (Modified according to subject, e.g., TIDAL)

Objective: To review material by matching questions with written answers.

Teacher Preparation: Construct about 15 variations of a Bingo card (four are shown in Figure 1), and provide enough "chips" to cover squares (students can tear up some pieces of paper, or you could use lima beans, or other material). As a teacher, you need to

prepare a series of questions with one word answers. These questions might be written on slips of paper and drawn from a jar.

Class Procedure: Each student or team has a bingo card. The teacher or designated student draws and reads a question. If the answer is presented on a Bingo card, then cover the word with a "chip". Student will need to know the answer to cover it with a chip.

To win, chips must cover correct answers in vertical, horizontal, or diagonal line.

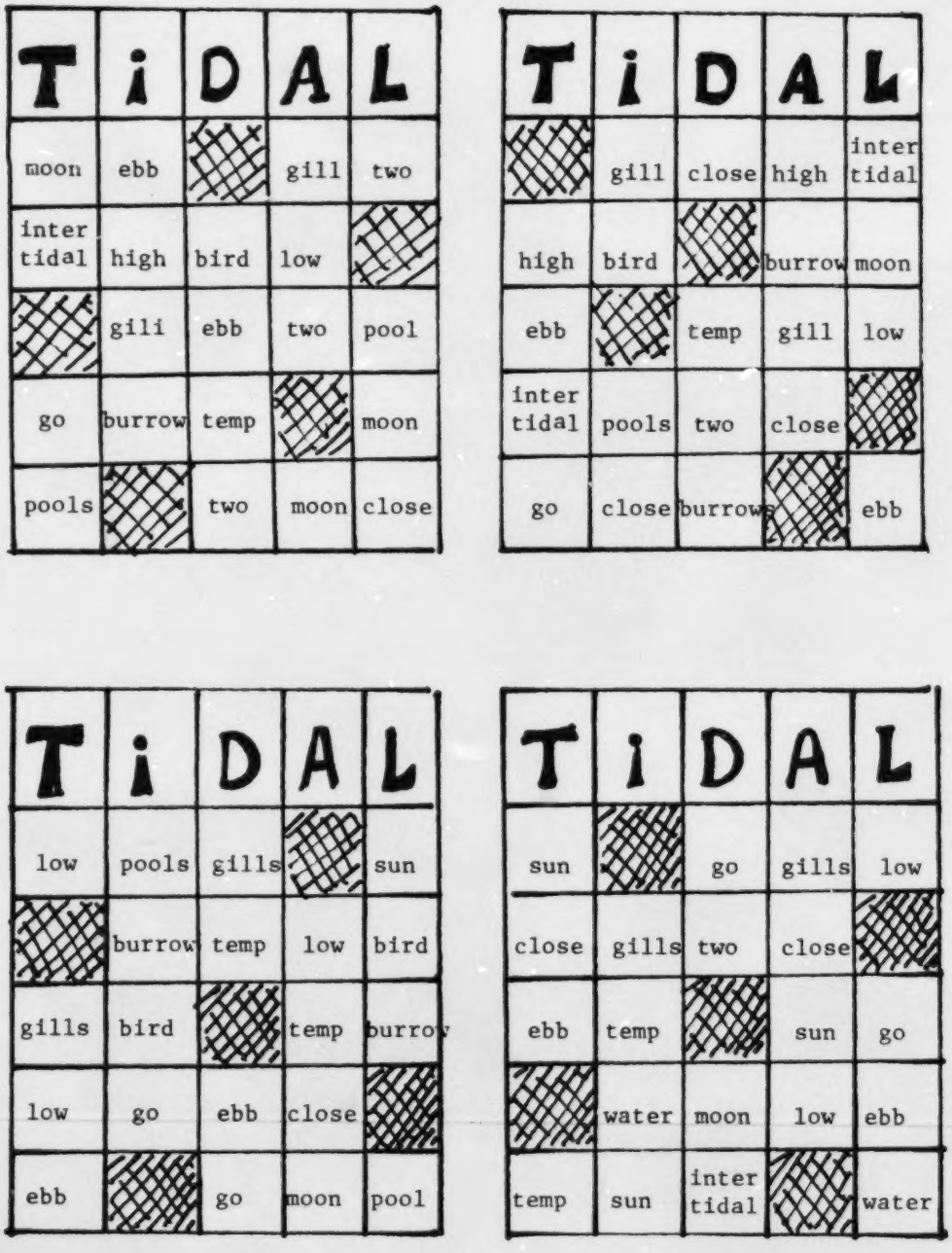
Sample Questions and Answers:

Words: moon, ebb, high, bird, temperature, gills, intertidal, close, low, burrow, go, pools, two, sun, water.

Questions:

1. The most gravitational pull on sea water comes from _____ (moon).
2. When the tide is going out, we say that it is on the _____ (ebb).
3. When the tide is furthest up on the beach, we say it is _____ (high).
4. A predator of the intertidal fiddler crabs at low tide is _____ (bird).
5. An oyster in the intertidal zone must be able to withstand extremes of _____ (temperature).
6. Ghost crabs must run back to the water frequently in order to wet their _____ (gills).
7. Between high and low tide marks is the _____ zone (intertidal).
8. Oysters and barnacles which cannot leave at low tides simple _____ their shells (close).
9. Shell collecting is best at _____ tide (low).
10. Some animals cannot leave the intertidal zone or close tightly, so animals like razor clams and coquina _____ (burrow).
11. Most fish cannot live in the intertidal zone at low tide, they must _____ (go).
12. Small pockets of water left at low tide are called tidal _____ (pools).
13. North Carolina tides come _____ times a day (two).

Figure 1--Sample Bingo Card


T i D A L
moon ebb gill two
inter tidal high bird low
gili ebb two pool
go burrow temp moon
pools two moon close
T i D A L
gill close high inter tidal
high bird burrow moon
ebb temp gill low
inter tidal pools two close
go close burrow ebb
T i D A L
low pools gills sun
burrow temp low bird
gills bird temp
low go ebb close
ebb go moon pool
T i D A L
sun go gills low
close gills two close
ebb temp sun go
water moon low ebb
temp sun inter tidal water

14. Tides are influenced slightly by gravity or _____ (sun).

15. Oysters at low tide hold _____ in their shells (water).

3. Marine Tic-Tac-Toe

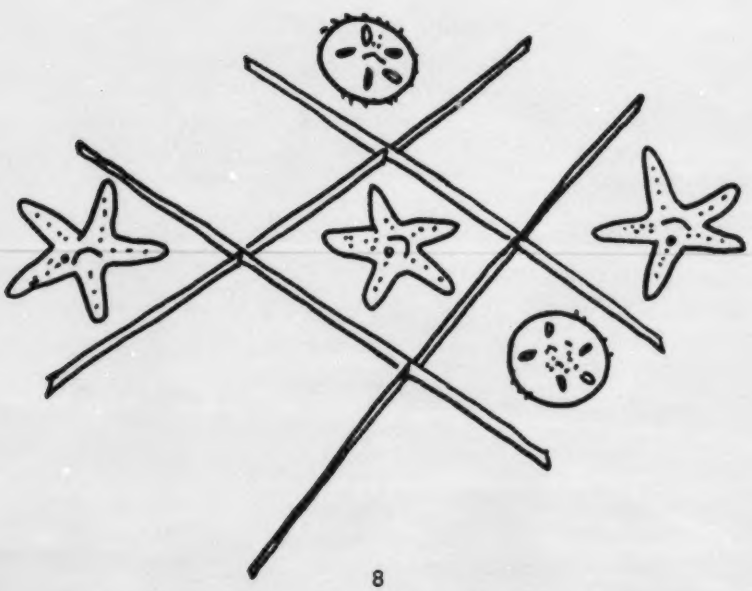
Objective: To review material by answering questions with one team competing against another.

Teacher Preparation: A series of questions are made up to cover the material to be reviewed.

Class Set Up: Divide a class or group into two teams, each with an elected spokesperson. A chalk board or bulletin board with a tic-tac-toe board drawn on it is needed as well as chalk or markers to represent "O" and "X".

Game Rules:

1. Coin toss to determine which team starts first.
2. The teacher asks a question of Team A; the group collaborates and replies. If the reply is correct, the team gets a chance to answer and place their marker. No correct answers mean no markers.
3. The second question is then asked to the other team for a correct or wrong reply.
4. To win, one team must align its markers vertically, horizontally, or diagonally. If impossible the game is a draw with no points or equal points for both.



4. Charades

Objective: To have students mimic animal behavior or describe an animal with words.

Teacher Preparation: Review marine animals with students, show films, slides, or Super-8 loops of moving animals. Some type of timer is needed.

Game Rules: Divide class into two sides. Have each side make up a list of animals for the other team. A student from one side will choose a slip from the other team with the animal's name. He will then try to act out that animal so that his team will be able to guess correctly. Teacher or designated student should measure the time it takes to guess correctly. (Stop at 3 minutes).

Repeat, alternating from side to side. The side guessing the most animals in the least amount of time wins.

5. Word Puzzles

A. Cross-word Puzzles

Objective: To review material studied and review spelling.

Teacher Preparation: Construct a crossword puzzle of review words with an accompanying definition sheet for "down" and "across" words.

B. "Seek and Find"

Objective: Word recognition

Teacher Preparation: Prepare a list of key words on a grid or on graph paper, arranging them vertically, horizontally, or diagonally. Then fill in the remaining spaces on the grid with extraneous letters. Transfer this completed grid to some form of duplication - zerox, memeo, or thermofax.

Game Rules: Each student is given a copy of grid sheet and asked to locate "X" number of words.

APPENDIX C

General Resources

A. Bulletins, Journals and Magazines

Aquanotes (free)
Louisiana State University
Sea Grant
Baton Rouge, LA 70803

Audubon Magazine
Membership Department
950 Third Avenue
New York, NY 10022
$13.00 (Bi-monthly)

Information
New England Marine Advisory Service
University of Rhode Island
Narragansett Bay Campus
Narragansett, RI 02882
$2.00 one time charge (Bi-monthly)

Maritimes (free)
Graduate School of Oceanography
University of Rhode Island
Narragansett Bay Campus
Narragansett, RI 02882

National Geographic Magazine
National Geographic Society
17th & M Streets, NW
Washington, D.C. 20036
$10.00 (Monthly)

Natural History Magazine
The American Museum of Natural Hist.
Central Park West at 79th Street
New York, NY 10024
$10.00 (Monthly/OCT-MAY,
Bi-monthly/JUN-SEP)

Sea World Magazine
National Marine Education Assoc.
1250 Sixth Avenue
San Diego, CA 92101
$15.00 (Quarterly)

Oceans Magazine
P.O. Box 65
Uxbridge, MA 01569
$12.00 (Bi-monthly)

Oceanus Magazine
Woods Hole Oceanographic Inst.
Woods Hole, MA 02543
$8.00 (Quarterly)

Sea Frontiers & Sea Secrets
Internat'l. Ocean Foundation
3979 Rickenbacker Causeway
Virginia Key
Miami, FL 33149
$15.00 (Bi-monthly)

Skin Diver
P.O. Box 3295
Los Angeles, CA 90028
$9.00 (Monthly)

Smithsonian Magazine
Smithsonian Associates
900 Jefferson Drive
Washington, D.C. 20560
$10.00 (Monthly)

Underwater Naturalist
American Littoral Society
Sandy Hook
Highlands, NJ 07732
$7.50/student, $10.00/
individual, $12.50/
family & library
(Quarterly)

North Carolina Sea Grant
Bulletin Newsletter
(Free)
NC Sea Grant Office
NC State University
Raleigh, NC 27607

Encyolopedia Britannica
Pamphlets (Free)
425 N. Michigan Avenue
Chicago, IL 60611

B. Film Addresses

BFA Educational Media
467 Severna Drive
Severna Park, MD 21146

Coronet Instructional Media
65 East South Water Street
Chicago, IL 60601

Churchill Films
622 North Robertson Blvd.
Los Angeles, CA 90069

Dept. of the Navy
Naval Education & Training
Support Center
Atlantic Commanding Officer
Naval Station; Bldg. Z-86
Norfolk, VA 23511

Encyclopedia Britannica
Educational Corporation
425 North Michigan Ave.
Chicago, IL 60611

EPA
Modern Talking Picture Services Inc.
Central Distribution Office
2323 New Hyde Park Road
New Hyde Park, NY 11040

National Film Board of Canada
16th Floor
1251 Avenue of the Americas
New York, NY 10020

Harper and Row Publishers, Inc.
10 East 53rd Street
New York, NY 10022

Indiana University
Audio-Visual Center
Bloomington, IN 41401

Martin Moyer Productions
900 Federal Avenue
Seattle, WA 98102

McGraw Hill
330 West 42nd Street
New York, NY 10036

Milner Fenwick Inc.
3800 Liberty Heights Ave.
Baltimore, MD 21215

Motion Picture Service
Department of Commerce
NOAA
12231 Wilkins Avenue
Rockville, MD 20852

Paramount Oxford Films
8451 Marathon Street
Los Angeles, CA 90038

Shell Oil Co. Film Library
450 N. Meridian Street
Indianapolis, IN 46204

Time-Life Films
100 Eisenhower Drive
Paramus, NJ 07652

UNC Sea Grant College
1235 Burlington Labs
NC State University
Raleigh, NC 27607

U.S.G.S. Films
Branch of Visual Services
303 National Center
Reston, VA 22092

C. North Carolina Coastal Films -- These are loaned free of charge --

1. UNC Sea Grant College
105 1911 Building, NCSU
Raleigh, NC 27607
(919) 737-2554

Waterbound -- Our Changing Outer Banks (18 min)

Currituck (25 min; color)

An Act to Protect (25 min; color)

(These films concern barrier islands, natural forces which cause them to change and subsequent problems which result from population pressure and development. Coastal Zone Management Act was developed to help counties develop plans to work with problems occurring on the coast.)

2. Agriculture Extension Service
NC State University
Raleigh, NC 27607
(919) 737-2861

Storm Tide (25 min; color)

(This film has similar emphasis on coastal zone management in relation to natural processes.)

3. North Carolina Coastal Resources Commission
Raleigh, NC 27611

Bogue Inlet: Study of Inlet Shifts (5 min)

(Five-minute film of physical changes of Bogue Inlet near Morehead City over a 20 year period.)

4. Office of Marine Affairs
119 Jones Street
Raleigh, NC 27611

Our Living Coast (27 min; color; excellent photography of North Carolina coast; animals; and Marine Resource Centers.)

5. North Carolina Wildlife Resource Commission
512 North Salisburg Street
Archdale Building
Raleigh, NC 27611

Outerbanks Fisherman (27 min)

(Write for information of other films, several available on marshes, SCUBA, and boating)

D. Federal and State Resources
Federal Government Addresses

1. U.S. Department of the Interior

Bureau of Land Management
Interior Building
C Street
Washington, D.C. 20240

Federal Water Pollution Administration
Washington, D.C. 20240

Fish and Wildlife Service
Washington, D.C. 20240

Geological Survey
Department of Interior Building
Washington, D.C. 20240

National Park Service
Division of Information
Washington, D.C. 20240

Office of Oil and Gas
Washington, D.C. 20240

Bureau of Outdoor Recreation
Division of Information
Washington, D.C. 20240

2. US Department of Commerce

National Oceanic and Atmospheric Administration (NOAA)
National Oceanographic Data Center
Washington, D.C. 20235

National Ocean Survey (NOAA)
Rockville, MD 20852

National Ocean Survey
6501 Lafayette Avenue
Riverdale, MD 20854: Marine Charts

National Weather Service (NOAA)
Washington, D.C. 20402

NOAA
439 West York Street
Norfolk, VA 23510: (Information Booklets)

National Marine Fisheries Service
Washington, D.C. 20240

Office of Coastal Zone Management (NOAA)
Washington, D.C. 20402

3. National Wildlife Federation
1412 16th Street, NW
Washington, D.C. 20036

4. Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20400: Free mailing of selected Government Publications.

5. U.S. Department of Defense

U.S. Naval Oceanographic Office
Washington, D.C. 20373

Office of Naval Research
Arlington, VA 22217

E. North Carolina Addresses

NOAA
Coastal Plain Regional Commission
116 Jones Street
Raleigh, NC 27607

National Marine Fisheries Service
Beaufort, NC 28516

Department of Natural Resources and Community Development

Coastal Resources Commission
116 Jones Street
Raleigh, NC 27607

Division of Marine Fisheries
Morehead City, NC 28557

Commercial and Sports Fisheries
Morehead City, NC 28557

Wildlife Resources Commission
Albemarle Building
Raleigh, NC 27607

Department of Administration

Office of Marine Affairs
Blount Street
Raleigh, NC 27607

NC Marine Resource Center/Bogue Banks
Route 1, Roosevelt Drive
Morehead City, NC 28557
(919) 727-0121

NC Marine Resource Center/Ft. Fisher
General Delivery
Kure Beach, NC 28449
(919) 458-8257

NC Marine Resource Center/Roanoke Island
Box 967, Airport Road
Manteo, NC 27954
(919) 473-3493

Department of Transportation

Division of Highways
Raleigh, NC 27611

Department of Travel
Raleigh, NC 27611

Department of Public Instruction

Division of Science Education
Division of Language Arts
Division of Social Studies
Education Building
Raleigh, NC 27611

Department of Public Instruction
TV Services
Raleigh, NC 27611

"What on Earth?", an instructional television series for eighth grade earth science, is designed to complement a sequential course of study in earth science texts. Twenty-nine programs have been produced which are aired on Educational-TV. Check TV Guide for schedule. Teacher's guides are available for each program along with slide packages keyed to scenes shown on the programs. These contain activities and resources.

Some programs are suitable for use in science classes above eighth grade. Several programs relate directly to concepts in marine education. These are listed below:

Film Number	Program: Subject
3	Forces That Act on the Earth: gravity and tides
8	Winds, Weather, and Air Masses: local breezes found at land-sea interface and mountain valleys.
10	Cyclonic Storms: pressure systems, fronts, and the typical lite cycle of a cyclone.
11	The Nature of Violent Storms: hurricanes with segments of "Connie", a major east coast hurricane.
15	Science and the Sea Part I: Cruise on Duke University's research vessel Eastward, covering techniques in navigation, sampling apparatus.
16	Science and the Sea Part II: continues to follow the cruise of R/V Eastward observing plankton tows, aquarium collection efforts, and geologic dredging.

Film Number	Program: Subject
17	Land Versus Sea -- The Interface: waves, beaches and seasonal beach change.
18	Land Meets Sea: shorelines around the world, aerial film from Maine, Alaska, Hawaii, California, Louisiana, and North Carolina. A naturalist explains a transect across a North Carolina barrier island.
19	Man and the Sea: wind and sand dunes, philosophical look at North Carolina coastline and thoughts on future development.
27	Sedimentary Rocks: conditions for forming sedimentary rocks and ancient environments.
29	Geological Time: develops concept of time scale.

F. U.S. Department of Interior

National Park Service
Cape Hatteras National Seashore
Ocracoke, NC 27960

Cape Lookout National Seashore
Beaufort, NC 28516

North Carolina Museums

NC State Museum
Raleigh, NC 27611

Hampton Mariners Museum
Beaufort, NC 28516

Department of Art, Culture and History
109 Jones Street
Raleigh, NC 27611

Division of Archives and History
Publications
109 Jones Street
Raleigh, NC 27611

University of North Carolina
Sea Grant College Program
105 1911 Building
North Carolina State University
Raleigh, NC 27650

G. Marine Careers Resources

Publications

University Curricula in Marine Science and Related Fields
(no charge) Director, National Sea Grant Program, NOAA, Department of Commerce, 300 Whitehaven Street, NW, Washington, DC 20235

So You Want To Be A Marine Scientist
Miami Sequarium, Rickenbacker Causeway, Miami, FL 33149

Training and Careers in Marine Science
(50¢; free to IOF members) International Oceanographic Foundation, 10 Rickenbacker Causeway, Virginia Key, Miami, FL 33149

Opportunities in Oceanography
($1.25) Smithsonian Press, Smithsonian Institution, Washington, DC 20560

Oceanography Information Sources
Printing and Publishing Office. National Academy of Sciences, 2101 Constitution Avenue, NW, Washington, DC 20418

The Oceans and You
($3.00) Marine Technology Society, 1730 M. Street, NW, Suite 412, Washington, DC 20036

Marine Occupations in the Texas Coastal Zone
College of Education, Texas A & M University, College Station, TX 77843

Occupational Outlook Handbook
U.S. Department of Labor, Bureau of Labor Statistics, Washington, DC 20212

Marine Career Series: Marine Related Occupations, A Primer for High School
Students. Marine Advisory Service, University of Rhode Island, Narragansett Bay Campus, Narragansett, RI 02882

The Need for Marine and Aquatic Education
Goodwin, Harold L.; Schaadt, James G., 1978. (single copy free, multiple copies $1.00 each) Available from: Sea Grant Communications Office, College of Marine Studies, University of Delaware, Newark, DE 19711

Today's Youth in Tomorrow's Sea
Goodwin, Harold L. (single copy free) Available from: Bulletin Clerk, Oregon State University, Corvallis, Oregon 97331 - Request SG-45

The Marine Careers Project
(free) Available from: Education Department, Marine Careers Project, Central Wharf, Boston, Massachusetts 02112

Career Opportunities at the New England Aquarium
(free) Available from: New England Aquarium, Central Wharf, Boston, Massachusetts 02110

Zoo and Aquarium Careers
American Association of Zoological Parks and Aquariums (free)
Available from: New Jersey Marine Sciences Consortium, Fort Hancock, New Jersey 07732

Employment Outlook for Oceanographers
Occupational Outlook Quarterly
Bureau of Labor Statistics
Washington, DC

Your Future in Oceanography with the U.S. Navy Hydrographic Office
U.S. Navy Civil Service Commission
Washington, DC

APPENDIX D

"Shifting Sands"

A Guide to Coastal North Carolina for Teachers

Prepared by Mary Olson and Charles Baker

Introduction:

"Shifting Sands" is a guide for the teacher who wishes to plan activities extending beyond the confines of school walls.

The idea of this material is to assist the teacher in planning meaningful, educational field trips throughout coastal North Carolina. The guide provides the usual information on places to visit, how to get there, where to park, what to wear, expenses to expect, resource people to contact, tours available, reservations, exhibits to be seen, nature talks, walks and much more. Other information includes tips on available medical services, overnight accomodations, restroom facilities and french fries when needed.

In short, this booklet was written by teachers for teachers and is hoped to be a useful source of information when planning for the beach trip.

The North Carolina coast can be divided into three geographical sections: I. Northeast to include northern Outer Banks, Currituck, Elizabeth City, and Edenton; II. Middle to include Morehead City, Atlantic Beach, and Beaufort; III. Southeast to include Wilmington, Southport, and southern beaches.

Several guides have been published to familiarize either citizen or teacher with the environment and coastal areas of these areas.

Pilkey, O., W. J. Neal, O. Pilkey, Sr. 1978. From Currituck to Calabash: A Guide to North Carolina's Barrier Islands. Science and Technology Research Center, Research Triangle Park, NC 27709 (charge).

Riggs, Stanley R., and Stephen B. Benton, (in press). The Northern Outer Banks of North Carolina. UNC-SG-78-03. UNC Sea Grant, 105 1911 Building, NCSU, Raleigh, NC 27650. (charge)

Pilkey, O. H., O. Pilkey, Sr., and Robb Turner. 1975. How to Live with an Island: A Handbook to Bogue Banks, North Carolina. Science and Technology Research Center, Research Triangle Park, NC 27709. $2.75.

Cleary, W. J. and Paul E. Hosier. 1977. New Hanover Banks: Then and Now. UNC-SG-77-14. UNC Sea Grant, 105 1911 Building, NCSU, Raleigh, NC 27650. $2.00.

Write for free brochure "North Carolina Coastal Country", Travel and Tourism, P.O. Box 25249, Raleigh, NC 27611.

The following is a list of places in our coastal area that can be visited on field trips.

I. Northeast North Carolina

1. Elizabeth City
   Museum of the Albemarle
   Route 17 South
   Admission: 50¢ adults
   919/335-1453
   Interesting exhibits of the coast's history.

2. Historic cities of Edenton and Bath
   Famous port cities of colonial importance, historic homes.
   Write specific Chamber of Commerce for information.
   Chamber of Commerce, Bath, NC 27808
   Chamber of Commerce, Edenton, NC 27932

3. The Northern Outer Banks
   Extending from Currituck south to Ocracoke Island make a fantastic ecological and historic tour of coastal sights. If you start from Ocracoke taking the toll ferry either from Cedar Island, or Swan Quarter, be sure to get the schedule and make reservations ahead of time. Ocracoke: 919/928-3841. Cedar Island: 919/225-3551. Swan Quarter: 919/926-1111. (Name and vehicle license number are required for making reservations.)

   a. Ocracoke
      Located at southern tip of Ocracoke Island on Route 12.

      Picturesque fishing village community with accomodations.
      Spot where Blackbeard the pirate was captured in 1718.
      National Park Service Visitor Center available.
      919/928-4531

      Sites of interest at Ocracoke:
      a. Visitor Center
      b. Howard Street - one of the oldest streets on Ocracoke; good idea of what life was like before World War II
      c. Methodist Church
      d. Lighthouse - oldest operating lighthouse on east coast
      e. British Cemetery
      f. Wahab Cemetery
      g. Wild Ponies of Ocracoke - about midway up the Island there is a sizable herd of wild ponies. A lookout stand is available. It is commonly speculated that the animals descended from Barbary ponies left by Sir Walter Raleigh's colonists.

b. "Museum of the Sea," Buxton, NC
919/995-5209

c. Cape Hatteras Lighthouse
Located near Buxton, on Hatteras Island

Tallest lighthouse on American coast; open to public.
Former keeper's residence is now a "Museum of the Sea."
Ample Parking
Facilities--restrooms
No charge
919/473-3991

d. Cape Hatteras National Seashore
70 miles of open beach on Bodie, Hatteras and Ocracoke Islands. Camping is permitted on three campgrounds (five in summer). Information on camping, education programs, and shipwrecks, write: Cape Hatteras National Seashore, Route 1, Box 675, Manteo, NC 27954. 919/473-2117

Nature Trail (near camping area): Good examples of plants, wildlife, freshwater swamps.
"Sand Castle" at Bodie Island. A children's nature center in South Nags Head, NC 919/441-6642
Buxton Woods
Nature Trail
Ample parking
Facilities--picnic tables, no restrooms

e. Jockey's Ridge State Park, Nags Head beside U.S. 158.
Largest natural sand dune on the eastern coast.

f. Wright Brothers National Memorial, Kill Devil Hills, NC
U.S. 158
Visitor center-museum, reconstructed hangar and shop, and airport mark spot where first powered air craft flew on December 17, 1903.
No charge
Facilities--restrooms
919/441-7430

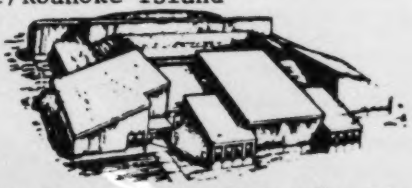
g. Ft. Raleigh National Historic Site: Where Sir Walter Raleigh's explorers and colonists discovered, laid out a town and attempted to establish a settlement 1584-87. Virginia Dare born at this site. Visitor Center with displays, films, etc. Ft. Raleigh National Historic Site Nature Trail: 919/473-2117 Manteo, NC on Roanoke Island.
No charge

h. Elizabethan Garden: Located at Ft. Raleigh, near Manteo. Snow Garden, wild flowers, trees, plants, and priceless pieces of antique statuary. 919/473-3234
Admission

i. "The Lost Colony" Theatre, Manteo. This outdoor drama is located at the Ft. Raleigh site.

Story of first English settlement in America. June 19-August 26. Nightly except Monday in Waterside Theatre.
Charge--tickets $5.00
Business Office--919/473-2127
Gift and Souvenir Shop--919/473-3763
Ticket Office--919/473-3414

j. N.C. Marine Resource Center/Roanoke Island
P.O. Box 967, Airport Road
Manteo, NC 27945
919/473-3493
Facilities--restrooms
No charge



Located near the site of the famous "Lost Colony", this facility highlights the wind-swept beaches and dunes of the Outer Banks and also the quiet backwaters of the sounds. Exhibits, films, marine aquaria and displays about the environment and its organisms.
Guides can lead field trips and provide "hands-on" educational experiences.
Ask for a calendar of events. Ask an educator at the center to design a field trip to meet your class needs.

k. Outer Banks Accomodations
There are numerous restaurants located along the banks in the larger towns. The same is true for motels. Overnight accomodations and restaurants are provided by private concerns in the villages adjacent to the boundaries of the park areas. The Dare County Tourist Bureau in Manteo, the Outer Banks Chamber of Commerce in Kitty Hawk, and the Ocracoke Civic Club in Ocracoke provide information on available accomodations.

l. Camping - National Park Service
Ocracoke, Frisco, Cape Point, Salvo, Oregon Inlet
For information and reservations, call 919/473-2117

There are also several private campgrounds in the Nags Head and Roanoke areas. There are also several private grounds from Ocracoke to Nags Head but not as many.
Kitty Hawk: Anderson's Trailer Court and Campground
919/261-2727
Hatteras: Hatteras Sands Campground, 919/986-2422
Manteo: Sandpipers' Trace, Ltd., U.S. 64, 919/473-3471
Roanoke Indian Country Campground, U.S. 64,
919/473-2463
Ocracoke: Ocracoke Oceanside Campground
Oregon Inlet: Oregon Inlet Campground
Salvo: Salvo Exxon and Trailer Park
Avon: Avon Trav-L Trailer Park, 919/995-3331

Cedar Island: Driftwood Campground (located by terminal for the Ocracoke Ferry)
Buxton: Bill and Barb's Camper Park, 919/995-4311
Cape Woods Camper Park, 919/995-3711
Waves: Holiday Inn Trav-L-Park, 919/987-2307
Rodanthe: Cape Hatteras KOA, 919/987-2250
North Beach Campground, 919/987-2378

m. Dare County Tourist Bureau
Box 399
Manteo, NC 27954
919/473-2751

n. Pea Island Wildlife Refuge: Between Oregon Inlet and Rodanthe. Wildlife includes snow geese and many species of water fowl during winter months. Spring to autumn a large variety of wading, shore and upland birds. Overlooks parking areas.

A bird count list is available:
Superintendent/Cape Hatteras National Seashore
Box 457
Manteo, NC
919/473-2117

o. Oregon Inlet Bridge: Spans Pamlico Sound and ocean inlet; three miles long.

p. Coquina Beach - 8 miles south of U.S. 158. Picnic shelters, bath houses, good swimming. Beach walks with NPS naturalists.

q. Shipwreck Laura Barnes: Wrecked in 1921; located on Coquina Beach.

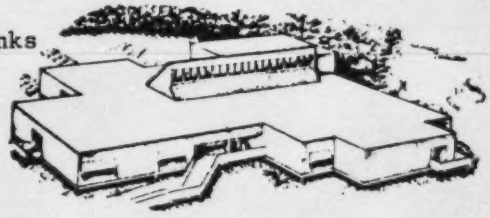
r. Bodie Island Lighthouse: 8 miles south of U.S. 158. Visitor Center with seashore information and natural history exhibits. Slide program.
No charge
Ample Parking
Facilities--restrooms
919/473-3991

Bodie Lighthouse Nature Trail: Excellent self guide trail on lighthouse grounds.

Bodie Island Marshes: Many speices of waterfowl during winter months. Egret, heron, glossy ibis, wading birds from spring to autumn. Near north entrance to NPS seashore.

II. Middle North Carolina

1. N.C. Marine Resource Center/Bogue Banks
Atlantic Beach, NC 28557
919/726-0121



Facilities--restrooms
No charge

Education comes in many shapes and sizes at this beautiful facility located near Atlantic Beach. Tour the aquaria, "Touch-Tanks," exhibits, and near-by Park Service Nature Walk.
The Center offers a rich variety of free programs to schools and other groups, featuring aquaria, exhibits, teaching labs, an auditorium and a library. Indoor programs and field trips stress involvement of participants and "hands on" activities. The Marine Resources Center is located 6 miles west of Atlantic Beach on Bogue Banks, one of North Carolina's barrier islands and is open to the public 9-5 Monday through Friday, 10-5 Saturday, and 1-5 on Sunday. Experienced staff are available to aid in designing a field trip or other educational experience for your class needs.

2. Ft. Macon Historic State Park
Site of old Civil War fort. Located two miles east of Atlantic Beach and next to Beaufort Inlet. Other activities in park include swimming, shelling and beach combing, bird watching, nature study and nature trail.
P.O. Box 127
Atlantic Beach, NC 28572
919/726-3775

3. Hampton Mariners Museum
Special exhibits of privateering documents, marine artifacts, boat building tools, and navigation tools and instruments. Outstanding exhibits of shells and marine life. Slide presentation and field trips to surrounding areas can be arranged.
No charge
Excellent for school groups

120 Turner Street	Monday-Friday	9-5
Beaufort, NC 28514	Saturday	10-5
919/728-7317	Sunday	2-5

4. Old Homes Tour - Beaufort, NC
Beautiful restored 18th century homes throughout Beaufort. Each is lived in today and furnished in the past. Beaufort is the second oldest city in North Carolina (Mayer, third oldest). There is also an old Courthouse and old jail to visit. The Old Burying Grounds are also very interesting.
Beaufort Historical Association
138 Turner Street
Beaufort, NC 28514
919/728-5225

5. Shackleford Banks, Bird Shoals, Carrot Island
A refuge for wildlife. Great for viewing birds and a variety of marine plant life. Wild ponies and goats roam the area freely. (Transportation to islands will be needed.)

6. Cape Lookout National Seashore - Headquarters Beaufort, NC
Lighthouse and caretaker's dwelling still intact.
Accessible by ferry or private boat. Beautiful shelling beaches, dunes, and private lore. Ferry departs Harker's Island twice a day. There is a fee for the ferry as it is privately owned, not state.

7. Theodore Roosevelt Natural Area
See unique plant/animal life of one of N.C.'s largest barrier island maritime forests. Self-guided trail winds among moss-draped live oaks, over relict dune ridges and along marsh. N.C. Marine Resource Center located within this beautiful 300 acre natural area and walks/slide programs may be arranged through them.

8. Aurora Fossil Museum, Aurora, NC
Resource facility teacher in-service and student field trips. The facility and staff provide an educational experience in coastal plain history, ocean levels, extinct creatures and sediment. Murals, films, tour of Texas Gulf Corporation, "touch and feel" fossil samples and fossil scrap piles give opportunities for students to learn about geologic history and even bring home their own fossils. Open Wednesday, Thursday and Friday for school tours. For field trips, contact: Rusty Walker
P.O. Box 1157
Washington, NC 27889
919/946-4181

9. Shell Piles at South River, NC
Extensive piles of calico scallop shells to scavenge through in search of offshore shells such as Scotch Bonnets, Sundials, Murex, etc.

10. Charter Boat Fishing Fleet, Morehead City, NC

Contact:	Capt. Josiah Bailey	Standard Fee:	$4 under 16
	919/726-5458		$6 over 15
	or		
	Cape Lookout Motel	You may get a group discount	
	Harkers Island, NC	if you call Capt. Bailey.	
	919/728-3082		

11. North Carolina State Port at Morehead City
One of the two shipping ports of North Carolina. Ships from around the world can be seen entering and leaving the port loading their holds. Trips can be arranged for school groups.
No facilities
No charge
919/726-3158

12. Harker's Island
Small island community which is the home of some of the biggest names in the U.S. in family boat building. Trips can be arranged to see this rare boat building process taking place. Rose Brothers is the most famous. Rose Brothers Boat Builders.
919/728-2763

13. Hammock's Beach State Park, Bear Island
P.O. Box 58
Swansboro, NC 28584
919/326-4881
Spectacular dunes. Relatively uncrowded beach. Free ferry every 30 minutes. Memorial Day to Labor Day. Twenty minute ride on intercoastal waterway. Restrooms, concession stand, picnic areas, life guard.
Highway 24 west from Swansboro about two miles then follow signs.

14. Croatan National Forest
The most "coastal" of any National Forest in eastern U.S. The Croatan Forest has many unusual attractions, some of which are unique. The unusual include many species of animals, birds, and plant life seldom seen elsewhere. Unique to this forest are the area of pocosins, and at least one plant species. Animal wildlife include migratory birds such as ducks and geese, egrets, hawks, bald eagle, and peregrine falcon, osprey, deer, alligators, and black bear.
Picnic areas are available. Ask for map and "Insect Eating Plants" brochure. For information: Croatan National Forest, District Ranger, 435 Thurman Road, New Bern, NC 28560

15. Aurora Fossil Museum
P.O. Box 373
Aurora, NC 27806
Murals, movies, fossils on display for students. Write for brochure.

III. Southern Coast

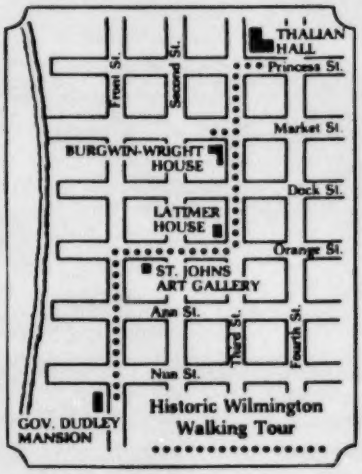
A. Wilmington and Wrightsville Beach

1. Wilmington - New Hanover County Museum
814 Market Street
Wilmington, NC 28401 919/763-0852 & 763-5679
Admission--none
Facilities--restrooms, gift shop
Hours--Tuesday-Saturday, 9am to 5pm; Sunday, 2pm to 5pm

Small but packed with history of nature and man. Permanent hands-on exhibit on human body; "the Incredible You" for all ages. Special programs by arrangement. Worldshells collection.
The Old Wilmington Map outlines a good walking trip for you and your students. Not only useful for learning history, the walking trip is an excellent time to examine architecture styles. Write the Wilmington Chamber of Commerce for the pamphlets "Old Wilmington, North Carolina" and "Old Wilmington Guide Map." These are excellent pamphlets giving short history and architectural information for many stops on this tour. Be sure to ask for other pamphlets too.

Wilmington Chamber of Commerce
P.O. Box 330
Wilmington, NC 28401
919/762-2611

2. Historic Wilmington Walking Tour
Admission--student group cost,
$2.25 per person
Hours--10am to 5pm Tues. thru Sat.
Tour takes 2-4 hours



Take a walk into the past; let your mind wonder and your imagination be your guide. See the old home sites as you walk the streets of historic Wilmington. Tour begins at Thalian Hall with an audio-visual presentation. Walking tour takes you to Thalian Hall (restored classic 19th century community theatre), Burguin-Wright House (colonial gentleman's town residence), Zebulon Latimer House (elegant 19th century residence), St. John's Art Gallery (Old Masonic Lodge in North Carolina, now an art gallery), and the Governor Dudley Mansion (home of first elected North Carolina governor). After the Governor's Mansion there is transportation back to Thalian Hall or you can have your own transportation meet you there. Old Wilmington, Inc.
P.O. Box 1862
Wilmington, NC 28401

3. St. John's Art Gallery
114 Orange Street
Wilmington, NC 919/763-0281
No admission
Hours--Tuesday thru Saturday, 10am to 5pm

Historic building 170 years old; former residence, lodge, restuarant and antique shop now housing a treasure of art emphasizing that from the south. Garden in back replicating old garden from 100 years ago. Some of the plants are from the originals, e.g., the roses that came from England over 100 years ago.

4. First Presbyterian Church
3rd and Orange Street
Wilmington, NC

Good example of Cathedral with rose window and beautiful stone architecture.

5. Oakdale Cemetery
520 North 15th Street
Wilmington, NC 28401
919/762-5682
Facilities--none
No admission

A quiet place to reflect on the past. Cemetery is 117 years old. There is a tour of specially selected sites of interest marked by arrows. Tour includes characters such as Rose O'Neal Greenhow, famous confederate secret agent; Hon. Edward Dudley, first elected governor of North Carolina; Henry Bacon, architect of the Lincoln Memorial and many others. Good place to do tombstone rubbings.

6. Cape Fear Technical Institute
411 North Front Street
Wilmington, NC 28401
919/343-0481
Facilities--restrooms
No admission
Parking in lot beside new building

One part past, two parts present, one part future; Cape Fear Tech blends the culture and history of old Wilmington in a modern facility educating our youth for the future. Good trip for students: The library is a museum in itself. Furnishings are modeled after 18th century tavern. Many interesting sites here from ultramodern to early American. Guide is very good with students who thoroughly enjoy their fascinating visit to this library.
Students take tours right into classrooms and labs. Excellent to show them various programs continuing education has to offer. There is, also, an underwater habitat on display.

7. The Cotton Exchange
North Front Street
Wilmington, NC
A bale of fun wrapped in history! Located near Cape Fear Technical Institute, across the river from Battleship North Carolina. The Cotton Exchange is a commercial area, almost like a mini-mall. It is designed like old Wilmington and set on the Cape Fear River. A good place to go after touring Cape Fear Technical Institute. There is an old-timey ice cream shop!
Near Coast Guide ice breaker Northwind.
Ample parking in front of Nutt Street

8. University of North Carolina at Wilmington
919/791-4330
Facilities--restrooms, drink machines
No admission
Take a tour of this beautiful "college by the sea." Students can tour the various departments of the college and special

demonstrations or talks may be given by the instructors there if arranged well in advance. There is an excellent marine science program which could spark enthusiasm for your stay at the beach. Instructors are often willing to give short field trips if their schedules allow

9. Greenfield Gardens - Municipal Park
South of Wilmington on U.S. 421
919/763-9871
Facilities--picnicing, refreshments, restrooms
No admission
Are you ready for a picnic? Or just a place to relax and unwind? Greenfield Gardens is the answer. It's spacious, scenic, and relatively quiet. The kids can run, explore, or just relax under a shade tree around this beautiful cypress lake.
Parking lot beside park suitable for buses.

10. USS North Carolina (Battleship)
North of 421; intersection U.S. 17, 74, 76 and NC 133.
Facilities--restrooms, snack machine
Admission--school group rate--50¢ per student
Hours--September through June, 8am to sunset daily
Battleship is set up just as it would be when in action. Students explore all through the ship. They can read historical documents, view all aspects of life onboard and let their imaginations run wild.

11. Intracoastal Waterway Bridge at Wrightsville Beach
U.S. 74 east of Wilmington
Good area to observe local fishing, floundering and crabbing. Best at night. Small amount of parking. Park and walk under bridge. Sandy area suitable for small groups. Sandy beach leads into marsh area. Make sure students have long sleeves, long pants, shoes, socks and insect repellent.

12. Wrightsville Marina
Wrightsville Beach, NC
Facilities--none
No admission
Contact dockmaster
Good for sketching and observing small to mid-sized boats (privately owned). Good view of Intracoastal Waterway bridge. Shrimpers can be observed on the mainland side of causeway.

13. Office of Saline Water, Wrightsville Beach Test Facility
Wrightsville Beach, NC
No admission
Facilities--
The saline experimental water station shows how government and science join dollars with knowledge in an attempt to find a solution to the fresh water shortage by looking towards the sea. Tour begins with film on various test facilities,

purposes, processes and benefits. Guide will lead students through test facility, labs and outdoor set ups. Students even get to taste water distilled at plant. Parking available in front of plant. Brochures available for you and students.

14. International Nickel (INCO)
Wrightsville Beach, NC
919/256-2271
Facilities--
No admission
International Nickel is a big corporation with research trying to find metals that will resist corrosion. This facility clearly shows how scientific experiments must stand the test of time and how large corporations such as INCO must be willing to spend large sums of money to develop a competitive product. Tour begins with film, then leads into museum of various materials and tests, and continues into test facilities and labs.

15. Masonboro Jetty
Facilities--none
No admission
Location--South end of Wrightsville Beach
Drive until road ends
There is a small parking area where road loops around at end.
At the south end of Wrightsville Beach there exists a pile of controversial rocks placed by the Corps of Engineers in hopes of keeping the inlet open. Whether the jetty does more harm than good is a question that's not clearly understood. But one thing for certain and of real value to you is that these rocks provide many things to see and do.

Activities: Explore around rocks for many types of sea life making homes and seeking shelter.

16. Shell Island - Northern End of Wrightsville Beach

Not accessible by road. You need to enter beach at Johnny Mercers Pier or get permission to park at Holiday Inn. Walk is approximately three miles.
Excellent beach walk. If you time it at low tide you'll be able to explore many tidal pools. Good to walk up the beach and back on the sand road behind the dune where you walk the marsh edge back. Great for observing marsh life. This is a scarcely used section of the beach.
There are no facilities so make sure all needs are taken care of at pier.

17. Moores Creek National Military Park
Facilities--restrooms, drink machines, picnic areas
No admission
Hours--open daily 8am to 5pm

Location--20 miles outside of Wilmington. Take Highway 421 north from Wilmington. Take left on Highway 210 when it intersects 421. Follow this until you see the battleground signs.
Moores Creek, several acres of hills rolling in Revolutionary War history and covered with the finery of nature. There is a well done museum and rangers available to show classes around.

18. Cleary, W. J. and Paul E. Hosier, 1977. New Hanover Banks: Then and Now. UNC Sea Grant Publication UNC-SG-77-14. $2.00
Excellent field trip and motorists guide.

B. Southport

1. Orton Plantation
Facilities
Admission
If you have got the time and budget, Orton is a must stop. Beautiful gardens and plantation house depict how the elite of early North Carolina lived. Also, it is a good area to study coastal plant and animal life. Walking the road that leads into the plantation makes an excellent nature walk affording good opportunity to point out bird life. In pond just before getting to Orton you see many trees with osprey nests. You might even get to see an osprey.
Orton Plantation Gardens
Winnabow, NC 28479
919/371-6851

2. C P & L Nuclear Energy Plant
919/457-6041
Facilities--restrooms, picnic tables
No admission
Location: just outside of Southport. Parking available beside visitor's center.
Engineers say it's power for the people. The visitor's center shows the entire process from the reactor to the home. They explain the cost and tell us to conserve. Many audio, visual and manipulative displays set in ultra-modern atmosphere.

Suggested Activities: Teachers, why not tell your students about the questions of the likelihood of geological faults, the altering of coastal ecology, the availability of fissionable materials for future use and safety measures and standards imposed on this plant? After discussing these things, ask your students for their reactions to questions like economics vs. ecology, how to conserve electricity, or alternate power sources.

3. Old Southport Cemetery
Facilities--none
No admission
Cemetery dates back to 18th century. Ideal for historical investigations and tombstone rubbings.

C. Carolina Beach Area

1. Southport - Ft. Fisher Ferry
Facilities--none
Admission--Pedestrian 25¢
Car $1.50
Bus (no longer than 30 feet) $3.00

Summer Schedule

Southport

7 am 1 pm
9 am 3 pm
11 am 5 pm

Ft. Fisher

8 am 2 pm
10 am 4 pm
12 am 6 pm

Winter Schedule

Southport

8 am 1:30 pm
11 am 3:30 pm

Ft. Fisher

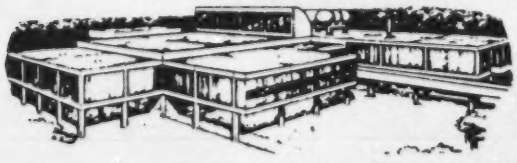
9:30 am 2:30 pm
12:30 am 4:30 pm

Ahoy, mates! Why not cast off and take a ride that's really a trip. Twenty to twenty-five minutes of salty adventure with the North Carolina Department of Transportation ferry service from Southport to Ft. Fisher. P.S. Don't forget to post your lookouts for herons, egrets, loons, the brown pelican or, if you're lucky, the water turkey!

2. Carolina Beach State Park
P.O. Box 475
Carolina Beach, NC 28428
919/458-8206
Facilities--water hook-ups, bath house
Located in a pine forest just outside Carolina Beach. Ask park ranger to talk with students about the area.

3. NC Marine Resource Center/Ft. Fisher
General Delivery
Kure Beach, NC 28449
919/458-8247
Facilities--restrooms
No admission
A million dollar facility with a million things to do! Here are just a few of them!

Guide from center will meet class at rocks across from Ft. Fisher Museum. Students can explore this area at low tide.



They love finding all the creepy crawlers among the rocks. From here, students go to center facility where labs, aquaria, films, and a "Touch-Tank" are available. Field trips can be scheduled to study the beach and dunes. Tours of the center's exhibits allow students to choose what interests them. Ask for a calendar of events. Ask an educator to design a field trip for your class needs.

4. Ft. Fisher Museum
Kure Beach, NC
919/458-5530
Facilities--restrooms
No admission
Hours--Tuesday thru Saturday, 9am to 5pm
Sunday, 1pm to 5pm
Here's one you won't want to miss. See how science works to preserve our past. Excellent historical museum concerned mainly with the civil war and underwater archaeology. Short film will be shown.
Also, try contacting the State Underwater Archaeologist in the Underwater Preservation Lab on the side of the museum. Here is where underwater relics are cleaned, studied and preserved.

Parking in front of museum.

For Further Information Write

Southport and Brunswick Co.
Resources Development Commission for Brunswick Co.
P.O. Box 638
Southport, NC 28461
(919) 457-6356

Wilmington
Wilmington Chamber of Commerce
Wilmington, NC 28401
(919) 762-2611

Carolina and Kure Beach
Wilmington Chamber of Commerce or Pleasure Island Tourist Bureau
P.O. Drawer A
Carolina Beach, NC 28428

Wrightsville Beach
Wilmington Chamber of Commerce or Information Office
Waynick Blvd.
Wrightsville Beach, NC
(919) 256-2308

Onslow County
Jacksonville Chamber of Commerce
Box 765, HWY. 17
Jacksonville, NC 28540
(919) 347-3141

Morehead, Beaufort, Atlantic Beach, Carteret Co.
Carteret Co. Chamber of Commerce
P.O. Drawer B, Hwy. 70 West
Morehead City, NC 28557
(919) 726-6831

Hyde Co. (Lake Mattamuskeet, Ocracoke Island)
Hyde County Coordinator
Swan Quarter, NC 27885
(919) 926-5711

Dare Co. (Outer Banks, Manteo)
Outer Banks Chamber of Commerce
Box 202
Kitty Hawk, NC 27949
(919) 261-2626

Craven Co. (New Bern)
Chamber of Commerce
317 Middle Street
New Bern, NC 28560
(919) 673-3111

E. Marine Education Information

1. How does one go about finding useful marine educational materials?

The Virginia Institute of Marine Science (VIMS), with assistance from the National Sea Grant Program, has devised a national Marine Education Materials System (MEMS) for the collection, storage, retrieval, and dissemination of marine education materials.

All materials in MEMS are first reproduced onto microfiche, a type of microfilm on which up to 60 pages of printed information are filmed on a four-by-six inch card, thus solving the twin problem of compact storage and economical distribution. Then authors and/or publishers of the document are contacted, requesting permission to distribute the document on microfiche through the Marine Education Materials System.

An accession number is assigned to each entry and is classified by date, author, title, and source of publication. Descriptors are assigned, such as "wave," "sand," "salinity," and "fish," so that articles can be retrieved by subject. The publication is also classified as to the type of educational materials it is (lesson plan, field guide, curriculum, etc.) as well as by grade level. All this information is then punched on computer cards and entered into a computerized retrieval system.

The MEMS microfiche collection has three North Carolina locations: David Hill Library, North Carolina State University, Raleigh, North Carolina, Marine Resources Center/Roanoke Island, Manteo, North Carolina, and the Department of Public Instruction, Education Information Center, Raleigh, North Carolina. Requests to EIC for documents identified from the guidebooks will be duplicated and sent free of charge to people working in education.

2. Many states produce marine education materials. For general information, write for the following publication: The Need for Marine and Aquatic Education by Harold L. Goodwin and James G. Schaadt, March 1978, Delaware Sea Grant College Program, University of Delaware, College of Marine Studies, Newark, Delaware 19711. For specific inquiries, write to UNC-Sea Grant, Marine Education, 105 1911 Building, North Carolina State University, Raleigh, North Carolina 27611. Listed below are materials and material access addresses.

Project COAST
310 Willard Hallo-Education Building
University of Delaware
Newark, DE 19711

Write for Information:

A. Project COAST Brochure, giving rationale of the project and annotated list of 86 learning experiences with order form (free). Note: many of these learning experiences are referenced in North Carolina units.

B. A List of Books on Marine Environment for Children and Young People, annotated, 65 pages, $2.00.

C. Audio-Visual Aids, Games, and Art for Marine Environment studies, annotated, 89 pages, $2.00.

D. A Catalog of Curriculum Materials for Marine Environment Studies, Elementary and Secondary, 38 pages. $1.00.

E. An Annotated Bibliography of Periodical Sources for Marine Environment Studies, Newsletters, Bulletins, Journals, and Magazines, 21 pages, $1.00.

Full set of above items, $5.00 (excellent reference material).

3. Reef and Shore: Nature Study Program for Elementary School Children; 265 pages of activities and information. Cost: $6.00. Write to: Curriculum Research and Development Group, University Laboratory School, University of Hawaii, 1776 University Avenue, Honolulu, HI 96822.

4. Exploring Inner Space: A Guide to Teaching Marine Science. Man and the Sea
Write to: Mathematics and Science Center
220 Mountain Road
Glen Allen, VA 23060

5. Down Where the Water Is: A Coastal Awareness Activity Book by Sara S. Callaghan.
Write to: Rhode Island Coastal Resources
Management Council
83 Park Street
Providence, RI 02903